(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

26 JAN 2005

(43) International Publication Date
31 December 2003 (31.12.2003)

PCT

(10) International Publication Number
WO 2004/001809 A2

(51) International Patent Classification[7]: H01L

(21) International Application Number:
PCT/US2003/019984

(22) International Filing Date: 23 June 2003 (23.06.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

60/391,012	23 June 2002 (23.06.2002)	US
60/396,743	19 July 2002 (19.07.2002)	US

(71) Applicant *(for all designated States except US)*: ASML US, INC. [US/US]; 440 Kings Village Road, Scotts Valley, CA 95066 (US).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: HELMS, JR., Aubrey, L. [US/US]; 106 Cherry Blossom, Los Gatos, CA 95032 (US). KAPIN, Kerem [TR/US]; 58 Hope Drive, Watsonville, CA 95076 (US). LEE, Sang-In [KR/US]; 22608 San Juan Road, Cupertino, CA 95014 (US). SENZAKI, Yoshihide [JP/US]; 400 Clubhouse Drive, Aptos, CA 95003 (US).

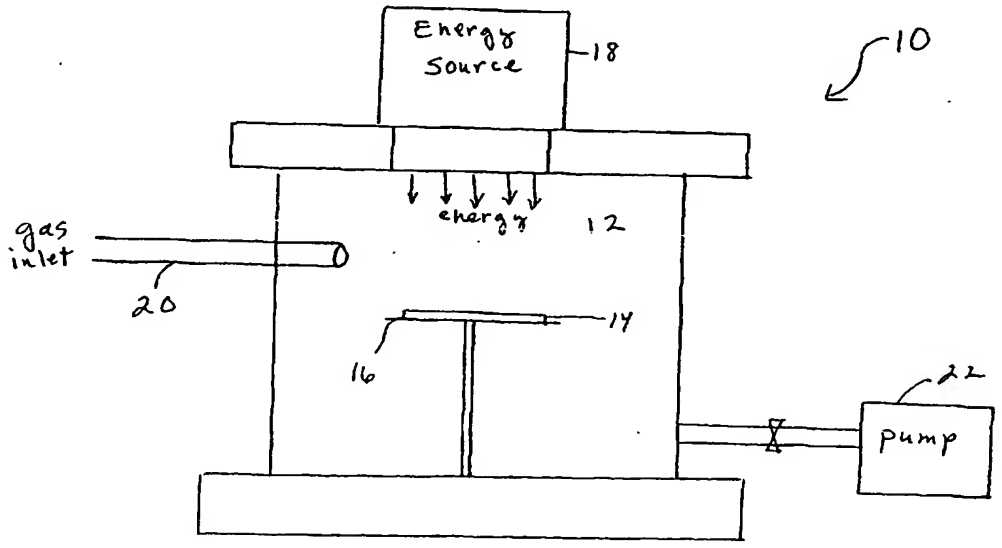
(74) Agents: SWIATEK, Maria, S. et al.; DORSEY & WHITNEY LLP, 4 Embarcadero Center, Suite 3400, San Francisco, CA 94111 (US).

(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO,

[Continued on next page]

(54) Title: METHOD FOR ENERGY-ASSISTED ATOMIC LAYER DEPOSITON AND REMOVAL



(57) Abstract: A method for energy-assisted atomic layer deposition and removal of a dielectric film are provided. In one embodiment a substrate is placed into a reaction chamber and a gaseous precursor is introduced into the reaction chamber. Energy is provide by a pulse of electromagnetic radiation which forms radical species of the gaseous precursor. The radical species react with the surface of the substrate to form a radical terminated surface on the substrate. The reaction chamber is purged and a second gaseous precursor is introduced. A second electromagnetic radiation pulse is initiated and forms second radical species. The second radical species of the second gas react with the surface to form a film on the substrate. Alternately, the gaseous species can be chosen to produce radicals that result in the removal of material from the surface of the substrate.

WO 2004/001809 A2

SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *without international search report and to be republished upon receipt of that report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.